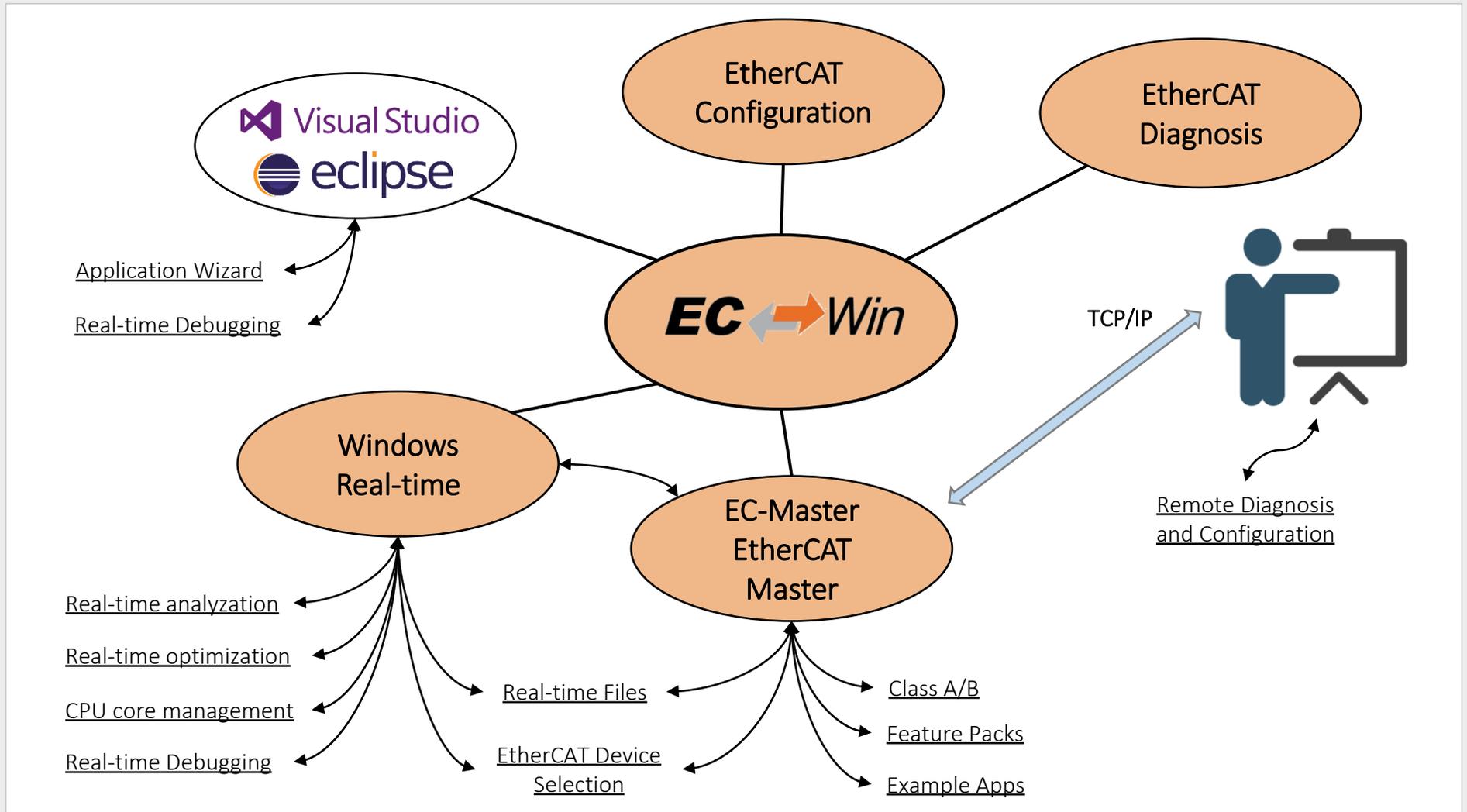




Windows EtherCAT® Real-time Platform based on Real-time Linux

Technical Presentation



- Core components
 - Windows Real-time extension based on Real-time Linux
 - EC-Master EtherCAT Master Stack for Linux
 - Running inside the real-time environment

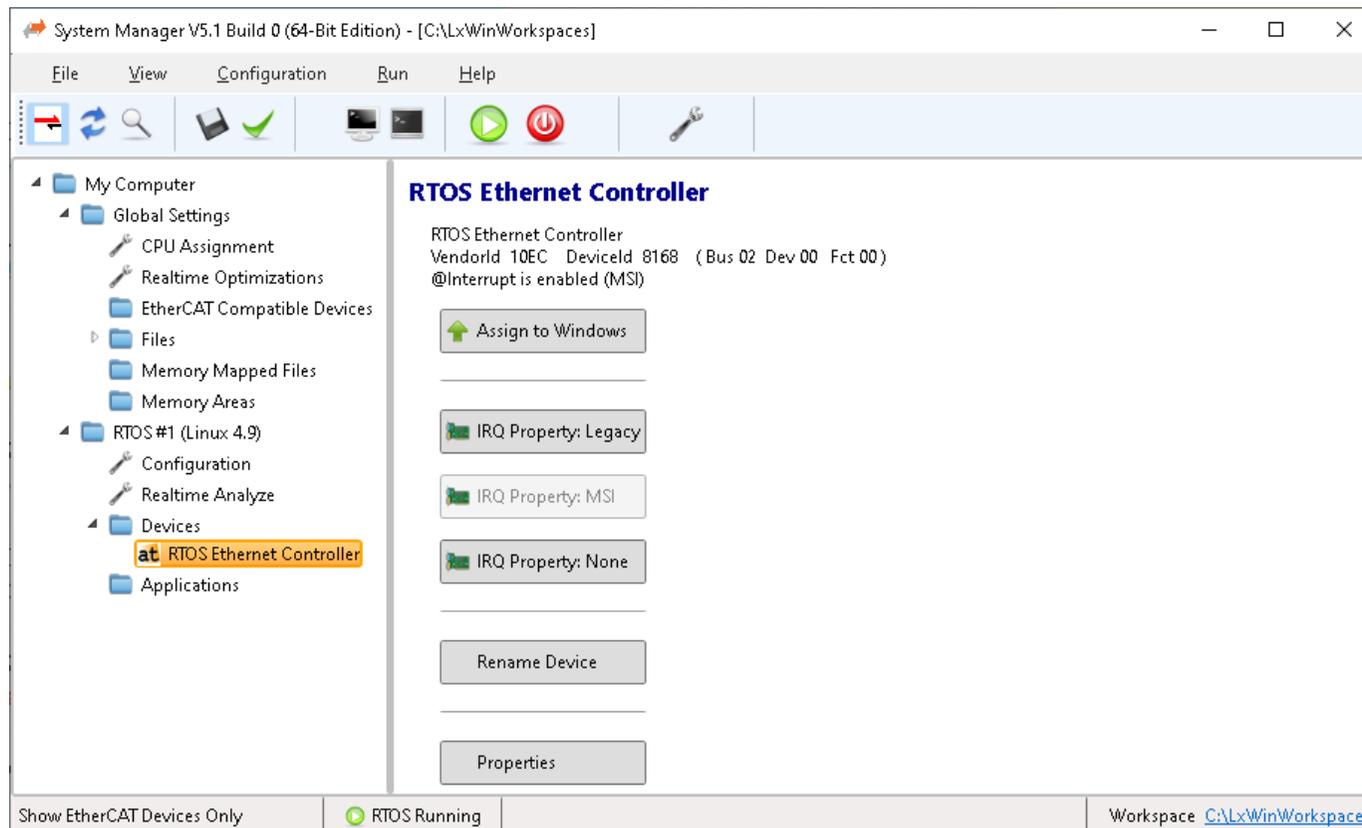
- Optional components
 - EC-Engineer: EtherCAT Configurator Tool
 - EC-Lyser: EtherCAT Diagnosis Tool
 - EtherCAT Master Feature Packs
 - Hot Connect
 - Cable Redundancy
 - TCP/IP Remote API (to connect with Remote Gateway)

EC  ***Win***

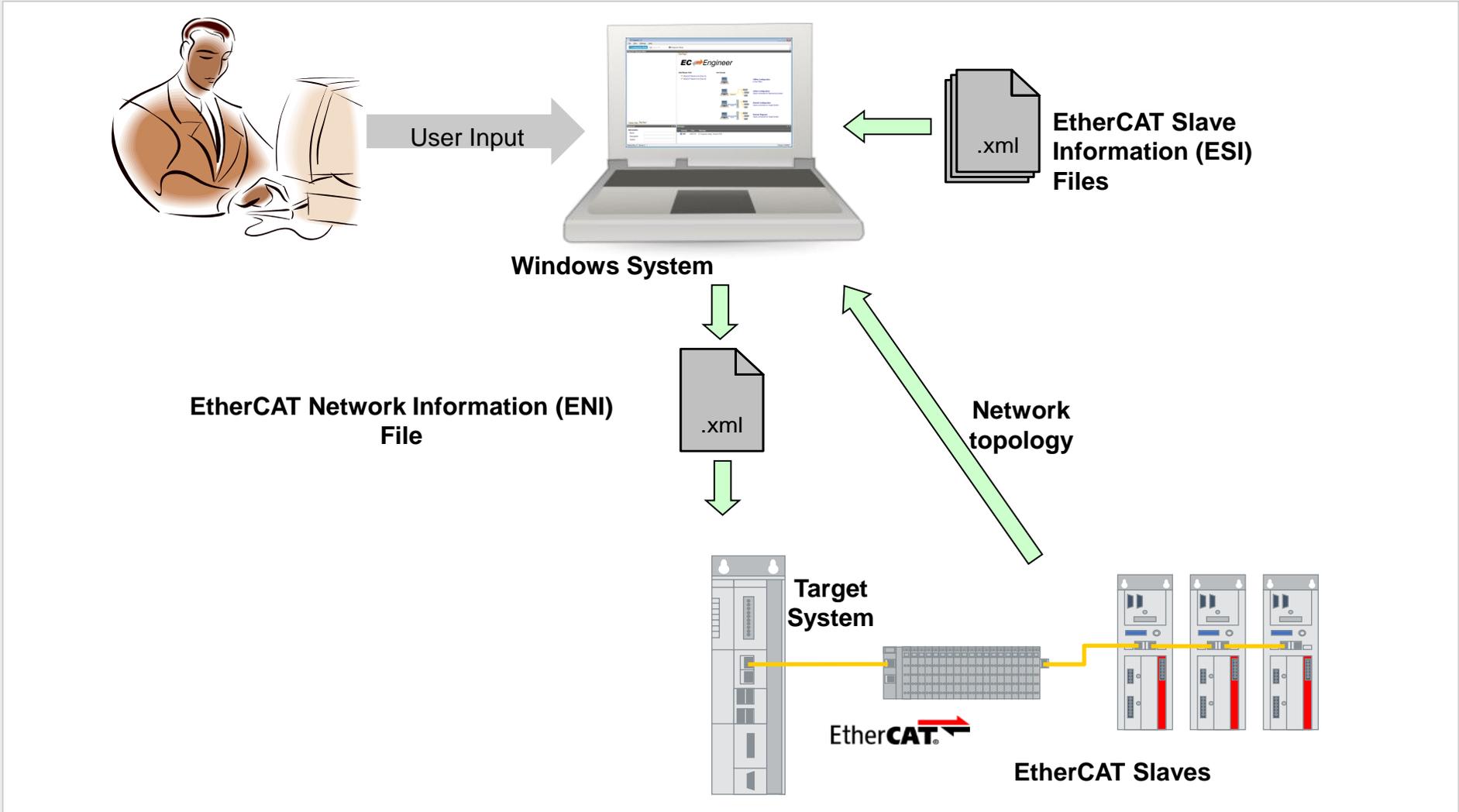
EtherCAT Integration

EtherCAT compatible Ethernet Controller

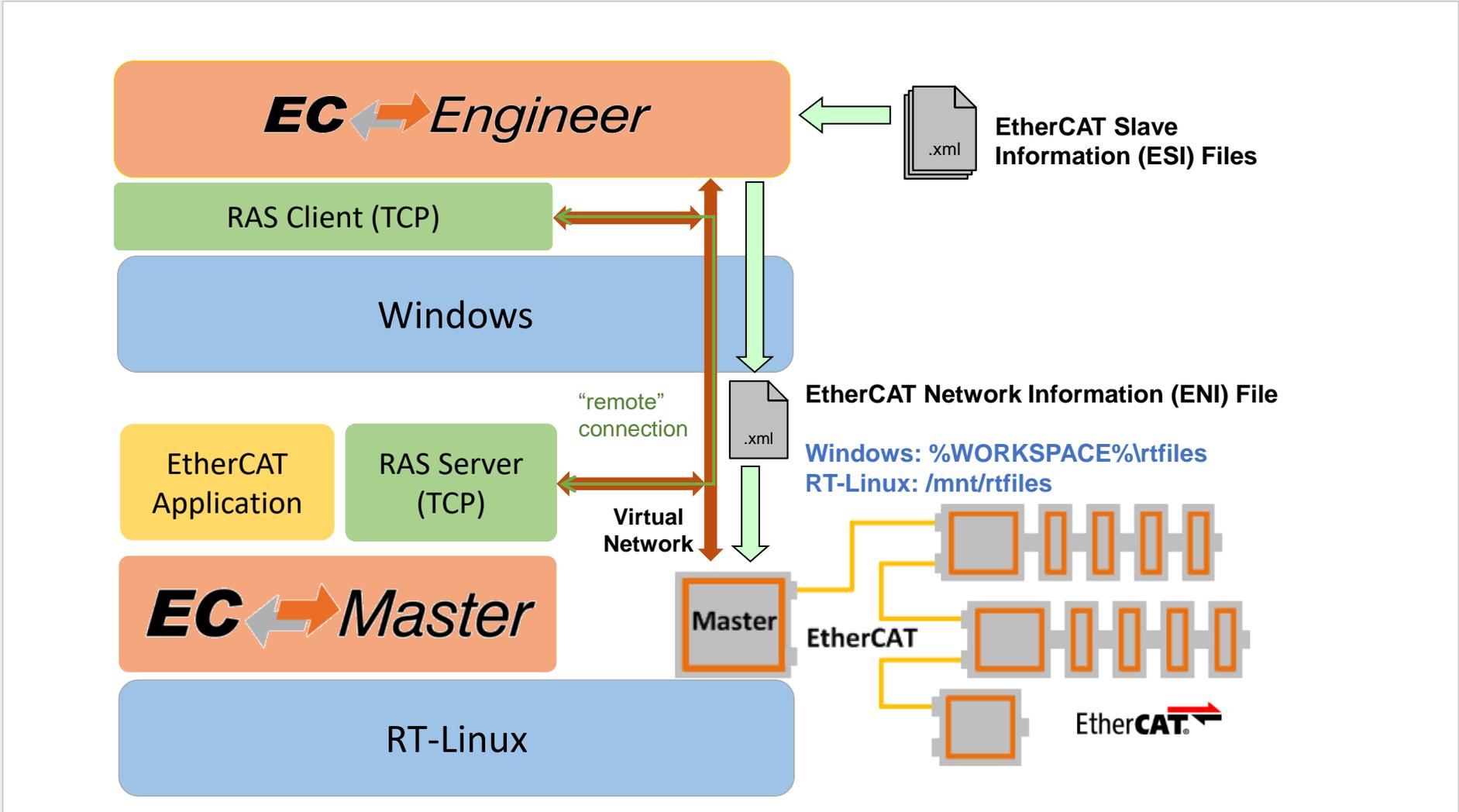
- Automatically detect all Ethernet Controllers that are supported by the EtherCAT master
- Assign to the real-time part



EtherCAT Network Configuration Data Flow



EC-Win (RT-Linux): "Remote" Configuration



EC  ***Win***

Typical Workflow

Step 2: EC-Engineer remote connection

- Default IP address: 192.168.157.2

The screenshot displays the EC-Engineer software interface. The main window is titled "EC-Engineer [--]" and has a menu bar with "File", "View", "Network", "Settings", and "Help". Below the menu bar, there are tabs for "Configuration Mode", "Export ENI", "Export EXI", and "Diagnosis Mode".

The interface is divided into several panes:

- Project Explorer:** Shows a tree view with "Class-A Master" selected.
- Device Editor:** Contains configuration fields for the selected device.
 - General:** Unit Name (Class-A Master), Cycle Time [us] (1000), Source MAC address.
 - Slaves connected to local system:** Real-Time Clock (checkbox), Link Layer (WinPcap), Network Adapter (Npcap Loopback Adapter (Npcap Loopback Adapter)).
 - Slaves connected to remote system:** Protocol (RAS), IP Address (192 . 168 . 157 . 2), Port (6000), Master-Instance (0).
- Short Info:** Information pane showing Name (Class-A Master) and Description (EtherCAT Master Unit (Clas...)).
- Messages:** Log pane showing a message: "INF 16:54:07 EC-Engineer ready. Version 3.2.2".

At the bottom, there is a status bar showing "Networks: 1 | Slaves: 0" and "State: ●● Mode: CONFIG | EXPERT".

Step 3: Scan the network

The screenshot displays the EC-Engineer software interface. The main window is titled "EC-Engineer [--]" and has a menu bar with "File", "View", "Network", "Settings", and "Help". Below the menu bar, there are buttons for "Configuration Mode", "Export ENI", "Export EXI", and "Diagnosis Mode".

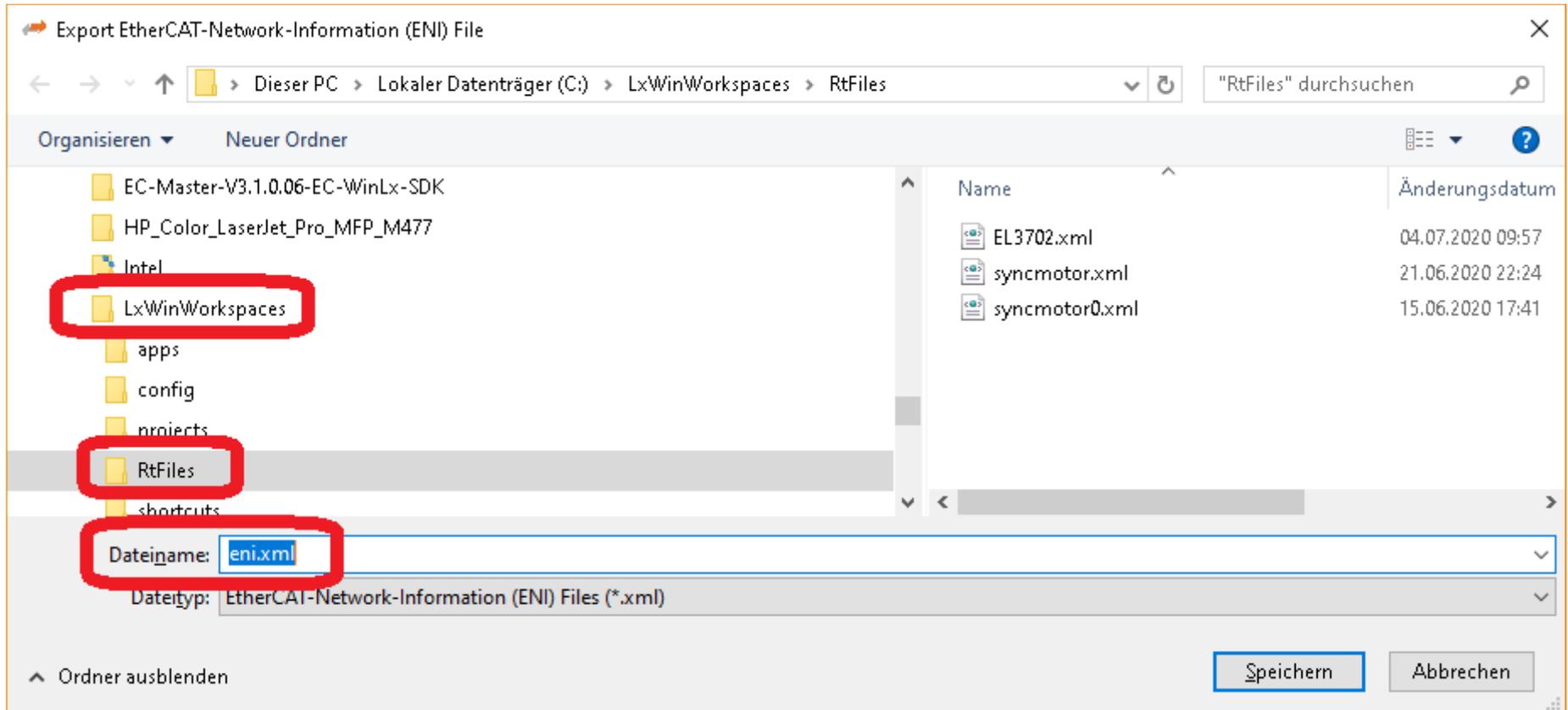
The interface is divided into several panes:

- Project Explorer:** Shows a tree view with "Class-A Master" expanded, containing "Slave_1001 [EK1100] (1001)" and "Slave_1002 [EL3702] (1002)".
- Device Editor:** The main configuration area for the selected device. It has tabs for "Master", "Process Data Image", "Variables", "Advanced Options", "Slave to Slave", "Distributed Clocks", and "Tasks + Sync Units". The "Master" tab is active, showing fields for:
 - General:** Unit Name (Class-A Master), Cycle Time [us] (1000), Source MAC address (B0-25-AA-08-65-E3).
 - Slaves connected to local system:** Real-Time Clock (checkbox), Link Layer (WinPcap), Network Adapter (Npcap Loopback Adapter).
 - Slaves connected to remote system:** Protocol (RAS), IP Address (192 . 168 . 157 . 2), Port (6000), Master-Instance (0).
 - Data to load from capture file:** (empty field).
- Short Info:** A pane showing information about the selected device, including Name (Class-A Master) and Description (EtherCAT Master Unit).
- Messages:** A log window showing system messages, such as "Master state change from 'Unknown' to 'Init'".

At the bottom of the window, there is a status bar showing "Networks: 1 | Slaves: 2" and "State: ●● | Mode: CONFIG | EXPERT".

Step 3: Export ENI

- Store in rtfiles directory in the LxWin workspace



Step 4: run master with ENI

VIO0 - PuTTYtel

```
root@vmf:/mnt/rfiles#
root@vmf:/mnt/rfiles#
root@vmf:/mnt/rfiles#
root@vmf:/mnt/rfiles# ./EcMasterDemo -f /mnt/rfiles/eni.xml -rtl8169 1 1 -sp
0000000043: Full command line: -f "/mnt/rfiles/eni.xml"-rtl8169 1 1 -sp
0000000044: Start Remote API Server now
0000000045: EC-Master V3.1.0.06 for EC-WinLx_x86 Copyright acontis technologies GmbH © 2019
atemsys: device_open(0xe8d78600)
atemsys: pci_find: ven 0x10ec dev 0xffff nInstance 0
atemsys: pci_find: device 0x10ec:0xffff:0 not found
atemsys: pci_find: ven 0x10ec dev 0x8169 nInstance 0
atemsys: pci_find: device 0x10ec:0x8169:0 not found
atemsys: pci_find: ven 0x10ec dev 0x8168 nInstance 0
atemsys: pci_find: found 0x10ec:0x8168:0 -> 0000:02:00.0
atemsys: pci_select: 0000:02:00.0
pci 0000:00:1c.1: Error enabling bridge (-19), continuing
PCI device used by VMF 0000:02:00.0
PCI device 0000:02:00.0 has VMF device ID 0 and uses interrupt ID 16 vector 240
atemsys: pci_conf: legacy INT configured for device 0000:02:00.0
atemsys: mmap: Doing PCI device sanity check
atemsys: mmap: mapped IO memory, Phys:0xd0604000 UVirt:0xb7764000 Size:4096
atemsys: mmap: mapped DMA memory, Phys:0x28e00000 KVirt:0xe8e00000 UVirt:0xb727f000 Size:528384
0000000063: EtherCAT network adapter MAC: B0-25-AA-08-65-E3
0000001082: Bus scan successful - 2 slaves found
0000001089: Master state changed from <UNKNOWN> to <INIT>
0000002010: Master state changed from <INIT> to <PREOP>
0000005007: DCM in sync Cur=" 1155", Avg=" 0", Max=" -29071"
0000005023: Cyclic command WKC error on LRD - Address: 0x10000000 - WKC act/set=0/1
0000005023: Master state changed from <PREOP> to <SAFEOP>
0000005033: Master state changed from <SAFEOP> to <OP>
```

- Master demo application parameters:
 - -f /mnt/rfiles/eni.xml → ENI file exported before
 - Master sets network into OPERATIONAL

Step 5: EC-Engineer remote diagnosis

The screenshot displays the EC-Engineer software interface in 'Diagnosis Mode'. The 'Project Explorer' on the left shows a hierarchy: 'Class-A Master <connected>' containing 'Slave_1001 [EK1100] (1001)' and 'Slave_1002 [EL3702] (1002)'. The 'Device Editor' on the right is set to 'Variables' for 'Slave_1002 [EL3702]'. It features a table of variables, a line chart, and an 'Edit Variable' section.

Name	Datatype	Master Sync Unit	Offset	Size	Value	Forced
Slave_1002 [EL3702].Ch1 CycleCount.Ch1 CycleCount	UINT	Id 0: Default 0	IN : 0.0	2.0	23050	<input type="checkbox"/>
Slave_1002 [EL3702].Ch1 Sample 0.Ch1 Value	INT	Id 0: Default 0	IN : 2.0	2.0	24	<input type="checkbox"/>
Slave_1002 [EL3702].Ch2 CycleCount.Ch2 CycleCount	UINT	Id 0: Default 0	IN : 4.0	2.0	23050	<input type="checkbox"/>
Slave_1002 [EL3702].Ch2 Sample 0.Ch2 Value	INT	Id 0: Default 0	IN : 6.0	2.0	17	<input type="checkbox"/>

The 'Chart' section shows a line graph with a y-axis from 0 to 40000. The data series shows a value that remains at 0 until approximately 17:39:42, then jumps to 23050 and continues to rise slightly.

The 'Edit Variable' section shows the current value of the selected variable as 23050. It includes radio buttons for 'Dec' (selected) and 'Hex', and buttons for 'Force' and 'Release'. An 'Add to watch list' button is also present.

The 'Messages' pane at the bottom shows two informational messages:

- Severity: INF, Time: 17:43:50, Message: ENI file saved to C:\LxWinWorkspaces\RtFiles\eni.xml
- Severity: INF, Time: 17:39:42, Message: Master state change from 'Unknown' to 'Init'

The status bar at the bottom indicates 'State: [Green Light]', 'Mode: DIAGNOSIS', and 'EXPERT'.

- Fully integrated EtherCAT real-time solution
 - one vendor, one support contact
 - Acontis has expertise for Windows real-time extensions back to 1994 and is leading provider for EtherCAT software since 2005
- Key Features
 - Win32 real-time platform base on Real-time Linux
 - Most popular and de-fact standard RTOS
 - Deterministic and hard real-time
 - Microsoft® Visual Studio® support for the non-real-time and real-time part of the software
 - Class A EtherCAT Master Stack
 - High Performance real-time Ethernet Drivers
- All runtime components included: No additional license required
 - License for EtherCAT Class A Master Stack
 - License for RT-Linux based Windows Real-time Platform